FACULTY OF MEDICINE | UNIVERSITY OF CALGARY

RESEARCH REPORT 2007/08

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Innovation improving health

Photo: John Gaucher

In my time as associate dean research, our Faculty of Medicine has grown in leaps and bounds. We have built the Health Research Innovation Centre (HRIC), a pair of new buildings that together nearly double our space for clinics, and almost triple our space for research. I am delighted to report that 2008 is THE year we are moving the bulk of our research institutes into the new laboratory building and the Teaching, Research and Wellness building of HRIC!

As you will see from this 2007–2008 Research Report, our most valuable asset continues to be our people – inspired scientists, physicians and students who have dedicated their careers to pursuing big ideas, and turning inspiration into results – substantial discoveries to improve the health not only of Albertans, but people across the globe.

Our faculty members are focusing on major scientific questions in the treatment of cancer, epilepsy, bone and joint injuries, multiple sclerosis, heart disease, and diabetes, just to name a few. Our clinical scientists and community health researchers are designing policy and new health delivery systems to meet the ever-growing health care needs of Albertans.

The research structure of our Faculty – built around six institutes and more than a dozen core research facilities – is an innovative matrix that facilitates translational research. This structure helps our scientists to rapidly translate basic biomedical findings from their laboratories over to clinics and hospitals where our physician-scientists apply that new knowledge in clinical trials and improved patient care. What we learn from those clinical trials then flows back into laboratories where scientists and physicians work together to improve treatments for devastating injuries and diseases affecting thousands of Albertans, and other people world-wide.

Of course, none of this would be possible without our primary partners, the Calgary Health Region, and the Alberta Cancer Board, and the major funding agencies that support our faculty members, the Canada Foundation for Innovation, the Alberta Heritage Foundation for Medical Research, and the Canadian Institutes of Health Research. There are also hundreds of agencies and individuals who generously give to our Faculty, providing the financial support that drives our research and development. Grants and contracts from federal and provincial governments, charitable organizations, industry, and individual donors have helped us make groundbreaking discoveries, and deliver results.

Valued at $40 million just five years ago, the University of Calgary Faculty of Medicine's total endowment is worth more than $96 million today. We now have 45 research chairs and professorships directing work at the Faculty. Ten years ago we had 15. And during the last funding period, we received $134 million in research grants and contracts. Reach!, the fundraising partnership between the University of Calgary, the Calgary Health Region and the Calgary Health Trust, has raised $250 million to date in support of medical research, education and leading-edge clinical care.

Whether you are a stakeholder in our day-to-day research enterprise, have participated in one of our clinical trials, or have contributed funding for one of our research initiatives, you are making a difference to the Faculty, to the University, and to medical research for generations to come. For that, I sincerely thank you.

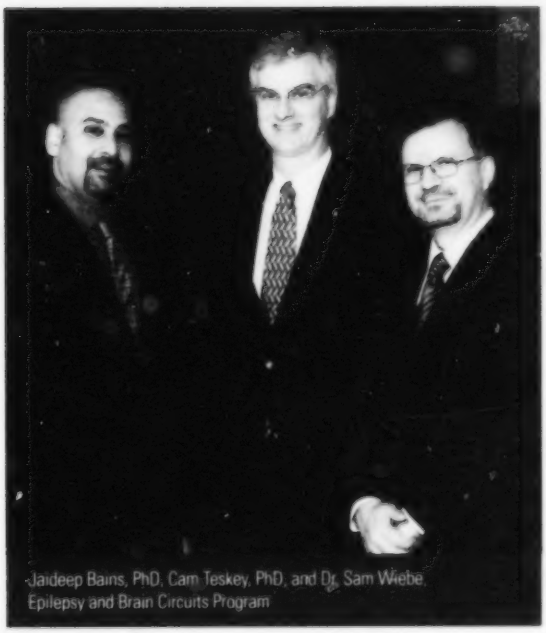
Dr. Richard Hawkes, Senior Associate Dean, Research
Faculty of Medicine, University of Calgary

Hotchkiss Brain Institute

The Hotchkiss Brain Institute (HBI) is a centre of excellence in neuroscience and mental health research and education. The integrative approach and collaborative model that the HBI has built provides unique training opportunities for the next generation of neurological and mental health researchers, and translates research discoveries into innovative health care solutions for Albertans.

The Institute, its programs and its members, enjoyed a successful year of research, education and outreach activities. Highlights include:

- **Arresting Multiple Sclerosis (MS) program**
  In early 2007, Jayman MasterBUILT contributed $1 million towards the development of a province-wide MS awareness and patient care strategy. That summer, Neuroscience Canada announced $1.5 million in funding to program co-leader V.W. Yong, PhD and his research team. Yong's co-leader Dr. Luanne Metz received $4 million in funding from the MS Society of Canada for an ongoing phase III trial using the antibiotic, minocycline, as a treatment for MS.
- **Movement Disorders and Therapeutic Brain Stimulation**
  The impact of music on Parkinson's disease
  The Movement Disorders and Therapeutic Brain Stimulation program obtained a $1.5 million Canadian Institutes of Health Research New Emerging Team Grant (over five years), led by Dr. Ben Hu, to study the impact of music for Parkinson's disease rehabilitation.
- **The Spinal Cord and Nerve Regeneration program**
  The regeneration of nerve cells interfaced with electronic chips
  Naweed Syed, PhD, and Dr. Doug Zochodne, members of the Spinal Cord and Nerve Regeneration program, in collaboration with other institutions, secured a CIHR Regenerative Medicine and Nanomedicine Initiative Team Grant worth $2.25 million (over five years) to study nerve cell regeneration in association with electronic chips.
- **Advanced Imaging program**
  This program, led by Jeff Dunn, PhD, and Dr. Mayank Goyal, secured funding support from Siemens Medical Solutions. The partnership will see approximately $8 million in equipment and technical support to the program over five years.
- **neuroArm Program**
  In April 2007, neuroArm, a magnetic resonance imaging (MRI)-compatible surgical robot developed by Dr. Garnette Sutherland, was announced to the world. The robot allows the neurosurgeon to see an image of the brain with superimposed tools on a screen in near real-time, while controlling the robot outside the operating room. Within minutes of its announcement, the development attracted international attention, from *The New York Times* to the *Times of India*. Dr. Sutherland has secured major financial resources from the Canada Foundation for Innovation, which will support its further development and transfer into clinical use.
- **Seed funding for new research areas:**
  To further enhance collaborative research and translation activity, the HBI provided seed funding for four new initiatives:
  1. Obesity: A Brain Disorder (led by Keith Sharkey, PhD, holder of the Crohn's & Colitis Foundation of Canada Chair in Inflammatory Bowel Disease Research)
  2. Perinatal Determinants of Brain and Mental Health (led by HBI member Bryan Kolb, PhD, at the University of Lethbridge)
  3. The Integrative Brain Tumour Research Centre (led by Dr. Greg Cairncross, in partnership with the Southern Alberta Cancer Research Institute)
  4. The Clinical Research Unit (led by Dr. Sam Wiebe, holder of the Kinsman Chair in Pediatric Neurosciences)



Jaideep Bains, PhD, Cam Teskey, PhD, and Dr. Sam Wiebe, Epilepsy and Brain Circuits Program

There's more to smell than meets the nose HBI study reveals the power of pheromones

"What's in a name? That which we call a rose. By any other name would smell as sweet."
-William Shakespeare

That famous Shakespearean quote could be even more meaningful to neuroscientists, thanks to the latest pheromone research at the University of Calgary's HBI.

"We found that pheromones, particularly dominant male pheromones, can stimulate the production of new brain cells in females," says Samuel Weiss, PhD, director, HBI, and neuroscientist from the Faculty of Medicine.

Weiss' research team at the HBI recently discovered that female mice, when exposed to the pheromones of dominant males, generated new brain cells. Interestingly, the scientists did not find the same results when the females were exposed to the scent from subordinates or lower-ranked members of the opposite sex.

The new cells were discovered in two areas of the female brain: the hippocampus where memory is held and the olfactory bulb where smell is created.

"These new brain cells play a very important role in the females choosing a dominant male," Weiss says. "And they did make a choice and they chose the dominant male."

During the study, the researchers also detected hormones linked to this brain growth.

"These hormones could potentially be useful when repairing the brain after damage or disease," Weiss says. "We are investigating this more in the lab."

Despite what his work has already revealed about neurogenesis, Weiss hopes this will lead to unlocking even more secrets within the brain.

"The more we understand the brain's natural processes, the more we can apply that knowledge and help people that need it."

Tackling epilepsy together HBI epilepsy team collaborates to battle common neurological problem

When University of Calgary professor Cam Teskey, PhD, thinks about the Epilepsy and Brain Circuits Program at the HBI, one word comes to mind: collaboration.

"What's unique about the program is that we've brought together a large number of individuals, with very different training specialties, into one team," says Teskey, co-leader of HBI's Epilepsy and Brain Circuits Program.

The collaborative team that Teskey speaks of is comprised of neurologists, neurosurgeons, nurses and researchers.

"To have the number of people working together that we do, is unique in Canada and perhaps in the world," he adds.

In addition to having a deep pool of professionals to draw from, the team also has an arsenal of leading-edge technology to help care for those with epilepsy. The tools they use include an fMRI (functional magnetic resonance imaging unit) and an EEG (electroencephalography) monitoring unit that not only captures any seizures the patient may be experiencing, but can pinpoint where in the brain the seizure is originating from. The Institute will also be welcoming a MEG (magnetoencephalography) system, which provides doctors with a more detailed look at the brain using magnetic currents.

Other members of the Epilepsy and Brain Circuits program are doing cutting-edge work that involves growing brain cells on computer chips and creating seizures within these cells so they can test new treatments.

"It's almost something out of Star Trek," he chuckles. "But we think this could be a fantastic screening tool for the development of new drugs."

Teskey wants to raise awareness about the condition that affects up to two per cent of the world's population.

"Epilepsy is the number one neurological disorder in the world in terms of expense," he says. "The scientist in me wants to solve the problem but the person in me wants to help alleviate the disease for all these people who are affected personally and socially."

New study reveals mini strokes shouldn't be taken lightly

The number of major stroke victims may decrease if minor strokes were treated as emergencies, according to a study by the HBI's Attacking Stroke program leaders, Drs. Andrew Demchuk and Michael Hill.

Their randomized clinical research trial combined clopidogrel, an anti-clotting drug, and aspirin, resulting in lower risk of a major stroke by almost four per cent in patients who had suffered from a Transient Ischemic Attack (TIA). TIAs or "mini strokes" produce stroke-like symptoms but don't have any permanent disabling effects.

"It was an exciting result, one that we were hoping for," says Hill, co-author of the study. "It's good news."

The Fast Assessment of Stroke and TIA to Prevent Early Recurrence (FASTER) study involved 392 patients in 18 health centres mostly across Canada and one in the US. The patients were randomly chosen but had to be enrolled in the study within 24 hours of TIA onset.

"The idea was to treat people with stroke symptoms quickly as opposed to discharging them from the emergency room and bringing them back to the clinic the following week," says Hill, who is also director of the Stroke Unit at the University of Calgary. "It's during that week when people could suffer a stroke."

Hill hopes this work will help prevent some of the 700 to 800 major strokes that occur in Calgary every year.

"The most important issue is that someone will commonly have a TIA before a stroke and we identified the best therapies to prevent that progression from happening."

Published in *Lancet Neurology*, the study was a pilot-sized project and Hill says they have their sights on a much larger research trial that will involve up to 5,000 patients from across the globe.

"If we can prove it in a big study and let the general population know, we will see a reduction in strokes and hence a reduction in mortality," he says.

The Calvin, Phoebe, and Joan Snyder Institute of Infection, Immunity and Inflammation

Through The Calvin, Phoebe, and Joan Snyder Institute of Infection, Immunity and Inflammation, the Calgary Health Region and University of Calgary are leading the fight against a host of serious health problems. Our goal is to create a world-class centre of research and care in areas of growing concern world-wide.

Kris Chadee, PhD

White blood cells to the rescue: The fight against sepsis

A flip of a coin, a 50/50 shot. Heads you live, tails you die. For patients with severe sepsis, these are the odds of survival. An estimated 400,000 North Americans die every year from the infection.

But hope is on the horizon following a study published in *Nature Medicine* last year by Paul Kubes, PhD, and his team of researchers. They discovered that white cells in the blood stream can be stimulated to release a sticky net that detects, traps and destroys harmful bacteria and viruses. Kubes holds the Calvin, Phoebe, and Joan Snyder Chair in Critical Care Research.

Kubes likens the process to swimming in a fast-flowing river trying to catch a fish. "Trying to grab those fish is nearly impossible. A net strung across the river can catch lots of fish. It appears white cells use the same technique. Problem is, this desperate measure does cause decreases in blood flow and injures tissues." In the study, Kubes identified a protein that is responsible for the making of these nets. Current studies are now focusing on that protein with the ultimate goal of using it to create new treatments for critically ill patients.

The current treatment regimen for sepsis includes bombarding patients with many medications to elevate blood pressure and prevent multiple organ failure, which happens when the immune system becomes hyper-activated in order to fight system infection. Antibiotics are also essential.

In addition to saving lives, Kubes' discovery is aimed at new treatments that would mean cost savings to the Canadian health care system, which currently spends $885 million a year on sepsis, an average of $30,000 per patient.

Kubes is now working with his clinical colleagues on a clinical trial, studying one of the drugs which is effective in modulating net formation. "It's very exciting. Normally it takes another 10 to 15 years, but in this case, our study was released just as pharmaceutical companies were looking at blocking this protein in clinical trials, so we should know the results very soon."

Millions of Canadians suffer pain and disability caused by infections including drug-resistant bacteria and emerging viruses – exacerbated by a weakened immune system. Almost as many individuals suffer from an over-functioning immune system including diabetes, hepatitis, inflammatory bowel disease and asthma. Many of these diseases are poorly understood, with few treatments and no cure in sight.

Recruiting top researchers to UCalgary, the Institute has four inter-locking areas of focus:

- Emerging infectious diseases
- Immunity and diabetes
- Pain and intestinal disease
- Inflammatory lung disease

These themes are interconnected by internationally-known researchers studying the diseases that lead to devastating inflammation. The Institute's mission is "to create a world class community of researchers and clinicians focused on the cellular processes and clinical consequences of infection, immunity and inflammation and the translation of this knowledge to the benefit of society."

The Institute focuses on issues that impact patients in Alberta and beyond: lung diseases such as chronic bronchitis and asthma, which affects 10 per cent of Canadians, many of them children; diabetes, which occurs when white cells cause the body to stop producing insulin, usually with no warning; liver diseases and digestive diseases such as Crohn's disease, which can cause intense and debilitating pain.

This past year, the Institute successfully attracted a Canadian Foundation for Innovation (CFI) grant in virology. The Alberta Institute for Virology, a partnership between the University of Alberta and the University of Calgary, secured a total of $22 million. The Institute spearheaded a second CFI grant, Advancing Canadian Wastewater Assets (ACWA), in partnership with Environmental Engineering and the City of Calgary, to study potential water-borne infections.

A step towards new treatment for IBS

For the estimated 2.8 million Canadians suffering from the pain and discomfort of Irritable Bowel Syndrome (IBS), there is hope of a possible relief, thanks to research at the Institute of Infection, Immunity and Inflammation.

While on sabbatical in France in 2006, University of Calgary researcher Nathalie Vergnolle, PhD, made a discovery aimed at a breakthrough treatment for the disorder.

Her findings, published in the March 2007 issue of *Journal of Clinical Investigation*, identify for the first time, a common mediator to the pathology of IBS.

"We have demonstrated that active proteases are released in quantity from the colonic tissues of IBS patients and that those proteases activate sensory neurons and cause pain for people with IBS," says Vergnolle. "This occurs because of a receptor called the protease-activated receptor-2 (PAR-2). We anticipate our study will lead to a therapy based on the use of protease inhibitors and/or PAR-2 antagonists to treat pain symptoms associated with IBS."

Currently no treatments or conclusive diagnostic tests exist for IBS, yet Vergnolle says the pathology remains the number one reason patients are referred to gastroenterologists.

While an effective treatment for the pain of IBS may be several years away, the research made by Vergnolle is a first important step towards this goal.

A new vaccine stops deadly parasite

An intestinal parasite that kills more than 100,000 people and causes illness in millions more worldwide annually, could be eradicated thanks to a new vaccine developed by a team of researchers at the Institute.

Led by Kris Chadee, PhD, the group has successfully completed animal and laboratory testing of a vaccine to treat amoebic dysentery, most commonly contracted through food and water contaminated by fecal matter.

Although an estimated 10 per cent of the world's population harbours the Entamoeba histolytica parasite, Chadee says 99 per cent of the time it remains harmless. However for the one per cent of people who develop the active disease, the results can be dire.

"For people who go on to get the invasive disease associated with amoebic dysentery and liver abscess, if it is left untreated, they will die."

Treatment is often unaffordable for those who need it – that means, in many cases, young children in developing countries.

This is why Chadee intends to partner with a non-profit organization in order to take the vaccine to clinical trials and distribute it for free to the populations most at risk of contracting the disease.

If these clinical trials show promise, the vaccine could be in widespread use in five to seven years. And like other global scourges successfully beaten back by aggressive vaccination campaigns like Polio, Chadee hopes amoebic dysentery will soon be added to the list.

Institute of Maternal and Child Health

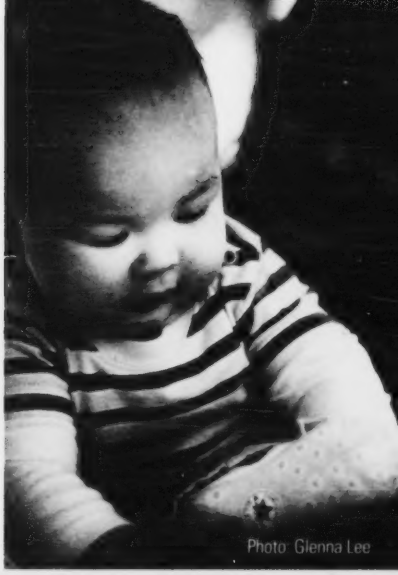


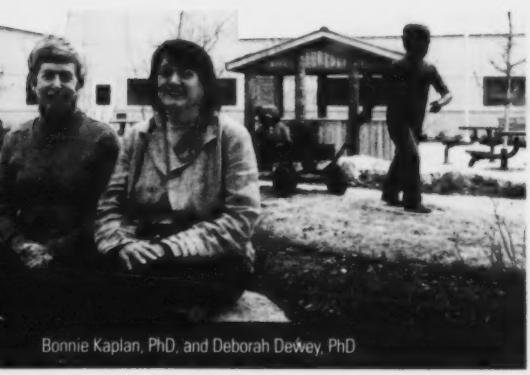
Photo: Glenna Lee

The IMCH's vision is "healthy pregnancies, healthy babies, healthy children, healthy lives" with the mission "to excel by international standards in the creation of knowledge and training of scientists and health professionals for the development of state of the art health care of mothers, children and communities." IMCH members are focused on the study of human development - from embryo into adulthood. The Institute brings together basic scientists, academic clinicians, clinician researchers and clinician scientists who are traditionally appointed in different departments within the University of Calgary and the Calgary Health Region.

"Our Institute is designed to overcome this traditional model because it is artificial," says James Fewell, acting director, Institute for Maternal and Child Health. "Human development is a continuum and we have designed the Institute to foster understanding of how events during early intrauterine development, be they genetic or environmental, can influence the trajectory of development through childhood and into adulthood."

The creation of the new Alberta Children's Hospital and, an anticipated new maternal and neonatal hospital on the West Campus of the University of Calgary, provide unique opportunities to grow new clinical, research and educational links.

In October 2007, the Alberta Heritage Foundation for Medical Research (AHFMR) announced the winners of the first Inter disciplinary Team Grant competition. IMCH is proud to have been awarded three out of four of the available grants through this program (highlights of the projects follow). The team grants program supports collaborative teams of researchers from different research disciplines and institutions to address important research questions or health problems. The program is also aimed at catalyzing existing provincial strengths in a given area of research into a position of international stature.


Bonnie Kaplan, PhD, and Deborah Dewey, PhD

The impact of maternal nutrient status during pregnancy on maternal mental health and child development

When team leaders Bonnie Kaplan, PhD, and Deborah Dewey, PhD, heard their research team at the Institute of Maternal and Child Health (IMCH) had received a $5 million boost from the AHFMR, both were pleasantly surprised.

"I was stunned," says a still-excited Kaplan.

"I was surprised and thrilled," echoes Dewey. "I knew how competitive and tough it was to get this grant."

Now their team of 16 researchers will take their work on the impacts of nutrition on maternal mental and child development to a much higher level. Over five years, the team will receive up to $1 million per year from the AHFMR.

The interdisciplinary team will focus its attention on showing how nutrition affects the mental health of the mother and the development of the child.

Kaplan believes the importance of this issue is sometimes overlooked.

"What I hope comes out of this research is a greater understanding of the relative importance of different dietary nutrients for brain growth, development and function," the research psychologist says.

With the grant, the IMCH group will set up a cohort of approximately 10,000 pregnant Alberta women to study and follow them throughout their pregnancies. The offspring of the pregnancies will be followed until they are three years old. Kaplan and Dewey hope this study will extend even beyond childhood, possibly into adolescence and adulthood.

"I think the grant could be the beginning of something big for Alberta and Canada," Dewey says.

The two scientists are devoted to demonstrating to the world that vitamins and minerals are essential for a healthy child and a healthy mother.

"This research could have huge implications," Kaplan says. "All of us are really passionately interested in this topic."

The Institute of Maternal and Child Health (IMCH) was established in 2004 as a centre of excellence in research and education in maternal, newborn and child health. The IMCH represents a partnership between the Alberta Children's Hospital Foundation, the Calgary Health Region and the University of Calgary. It has chosen eight themes to focus its research and education efforts:

- Molecular and genetic basis of development and child health
- Reproductive, maternal, fetal and newborn health
- Child development and mental health
- Pediatric neuroscience
- Pediatric oncology
- Innovations in child health research
- Healthy living and injury prevention
- Family centered care

Vaccine design and implementation

The IMCH's new vaccine research program is taking a multi-faceted approach to studying and developing vaccinations. This unique program also received a $5 million grant from AHFMR.

"The first of its kind in Canada, we have designed the vaccine program to include professionals from a wide range of backgrounds - from basic life scientists to mathematicians, physicists, physicians, health economists and public health researchers," says Dr. Anthony Schryvers, PhD, Faculty of Medicine professor in the Departments of Microbiology & Infectious Diseases and Biochemistry & Molecular Biology, associate director of the O'Brien Centre for the Bachelor of Health Sciences, and team leader of the program.

"We believe the program can make a global impact," adds Dr. Jim Kellner, professor, Department of Pediatrics, and co-team leader.

With children in Alberta receiving vaccinations against up to 12 infections by the time they're in grade five - that's up to 18 pokes in total - the program seeks to develop new products and approaches to immunization. The interdisciplinary team will carefully study pathogen distribution within the population, evaluate the pathogens' ability to change, improve vaccine evaluation strategies and create new approaches to predict the impact of candidate vaccines while developing new vaccines.

"The vaccines we have now are good, but because bacteria change over time, some vaccines will become ineffective," Schryvers explains.

"Some vaccines we use today are 85 years old," Kellner adds. "Because bugs change, we need to adapt vaccines to fight the changing bugs."

The program is organized into three interdependent components:

- Impact: This group will study how bacteria evolve within the human population, how they change their antigens and predict existing and new vaccines' impact on disease over time.
- Design: This group will develop products capable of providing protection against different strains and species of pathogens, and designed for the greatest long term impact on disease.
- Evaluation: This group will improve and develop assays and build relevant infection models to evaluate the effect of various vaccine formulations on disease prevention.

"The AHFMR grant creates greater opportunities in the future for us as we connect with other vaccination research initiatives and institutes in the world," Kellner says. "The new vaccine research program will put Alberta on the map as a centre for innovative vaccine development."

Preterm birth and healthy outcomes

Alberta has the highest preterm birth rate in Canada-why? That's the question UCalgary researcher Dr. Suzanne Tough and her team want to answer. Now, through an interdisciplinary team grant from the AHFMR, they are coming closer than ever to finding the answer-and possibly, a solution.

"We're not quite sure why preterm birthrates are increasing and why Alberta is such a hotspot," says Tough, co-team leader with Dr. David Olson from the University of Alberta of the group that won the $5-million grant.

Preterm births include children who are born before 37 weeks gestation when a full term pregnancy is 40 weeks. Tough says the question of why these births occur cannot be answered by only one discipline. Instead, this complex problem needs to be addressed by many experts - represented in her team of 20 individuals from Alberta, Ontario and Australia. The team's expertise includes genetic predisposition, social determinants of health (poverty, domestic violence) and maternal biology.

"This funding means we can look at how all these things come together and influence the outcome for babies," she explains.

The $5 million over five years will allow Tough and her team to collect and analyze information and biological samples from pregnant women in the community. It will also allow Tough to develop core facilities to store data and tissue samples.

The epidemiologist wants this research to reveal the science behind preterm births and then apply this information to community and clinical strategies with the goal of helping doctors develop interventions to reduce the likelihood of preterm birth and its complications.

"I also hope that over the course of the team grant, we'll all become comfortable working across disciplines to answer more complex questions," she adds.

Even though the research group officially began meeting in February, she says they actually began work together more than two years ago.

"This is a once-in-a-lifetime opportunity and the funding AHMF has provided is an incredible support," says Tough, who is also the scientific director for the Alberta Centre for Child, Family and Community Research. "We feel very privileged and excited to move this forward."

Dr. James Fewell, Acting Director • 3330 Hospital Drive NW • Calgary, AB, T2N 4N1 • www.imch.ucalgary.ca • fewell@ucalgary.ca

Libin Cardiovascular Institute of Alberta

On March 6, 2003, the Alvin and Mona Libin Foundation presented the largest one-time donation to the Calgary Health Region and the University of Calgary. The gift was $15 million, and the Libin Cardiovascular Institute of Alberta was born, giving Calgary a world-class institute for heart health research, education, and patient care. The Memorandum of Understanding formally establishing the Institute was signed by the University of Calgary, Calgary Health Region, and the Alvin and Mona Libin Foundation on January 27, 2004.

Heart disease gets one-two punch from combined tests

Through research at the Libin Cardiovascular Institute, physician-scientists have developed a new combination of tests to minimize compounding health problems for patients who have survived a heart attack.

By combining two different techniques, Dr. Derek Exner, a heart rhythm specialist and an associate professor at UCalgary's Libin Cardiovascular Institute of Alberta, and his team, have found a simple way of better identifying people at risk for cardiac arrest. One technique measures the heart's ability to adapt to sudden changes in heart rate, and the other measures the heart's ability to recharge. "We've improved our ability to identify people threefold, yet we're not losing out in terms of the reliability," Exner says.

One of the tests measures heart rate turbulence. The technique enumerates how the brain and the heart talk to one another through the autonomic nervous system. The brain regulates the heart on a heartbeat-by-heartbeat basis and heart rate turbulence determines how a heart adapts with an extra heartbeat or sudden changes in heart rate.

The second test – known as T-wave alternans – measures how the heart recharges or re-polarizes. T-wave alternans assesses if the heart recharges in a uniform way.

While the tests themselves are not new, the innovative idea of combining the two to further narrow the field of potential at-risk patients is promising, Exner adds.

According to Exner, 45,000 to 50,000 Canadians die every year from sudden death. Sudden death usually is the result of a very rapid heart rhythm problem called a cardiac arrest. "If you take the 45,000 people who die from sudden death each year – we think we can probably prevent a third to a half of those deaths, so we're looking at saving 15,000 to 25,000 lives a year. That's a huge number."

Existing testing methods identified one in five people at risk for sudden death, according to Exner. However, with Exner's new approach, three out of five patients will be given a better chance for care and the subsequent enhanced quality of life.

"If you add up all of the deaths from breast cancer, lung cancer, stroke – sudden death is about twice as common. In fact, it is the most common cause of death in North America so it's a huge public health problem," Exner adds.

The REFINE (Risk Estimation Following Infarction, Noninvasive Evaluation) study is a significant initial step in determining which groups of heart attack survivors are at risk. It found that the combination of tests to measure heart rate turbulence and T wave alternans worked best when measured at least two months after a heart attack.

The next step for Exner and other researchers at the Libin Cardiovascular Institute is to validate the combined test approach in a randomized trial. Of about 1,400 people who have the two abnormalities identified in the tests, half will be given an implantable defibrillator (a device that prevents sudden death from cardiac arrest) and half will be given standard care. The device is basically a deluxe pacemaker that regulates the heart and can deliver a shock to the heart in case of cardiac arrest.

"It's like having a paramedic in your chest," he adds.

Calcium transfer lies at the heart of the matter

New understanding about the key role of calcium in the heart and other parts of the body is at a turning point in the research process, according to an expert in molecular biology at the University of Calgary.

Jonathan Lytton, PhD, research director, Libin Institute, and professor of biochemistry and molecular biology at the Faculty of Medicine, says new insight into the role calcium plays in the body could improve the lives and health of people in the near future.

"Calcium is an essential element not only in forming our bones and teeth, but also in allowing our muscles to contract, our hearts to beat and our brains to think! It's easy to get excited about calcium, given the range of physiological functions in which it plays a key role," says Lytton, an AHFMR scientist.

Understanding calcium's role in the body can provide options for intervening when calcium balance goes wrong, Lytton adds.

With every beat of the heart, an electrical signal causes calcium stored inside heart cells to be released and reabsorbed. Within

The Libin Institute is not a building. It is a "virtual institute" in that it coordinates and integrates cardiovascular services across southern Alberta.

The vision of the Libin Cardiovascular Institute of Alberta is to provide a superb, efficient, integrated program of cardiovascular wellness, health care, research and education. The Institute's strengths include:

- Providing superb education and training of tomorrow's health care professionals including physicians, surgeons, researchers, nursing and technological staff.
- Development of an outstanding cardiovascular health promotion and disease prevention program that will educate and serve the population of southern Alberta.
- Increased access to cardiac services through innovative use of technology such as telehealth.
- Providing world class treatment, using state-of-the-art technology and equipment for patients from southern Alberta, British Columbia and Saskatchewan (link to CMR Centre).
- Increasing personnel and capacity of facilities to better meet the needs of the patient population.
- Fortifying cardiovascular basic science, clinical science, population health research, and the relationships among them.
- Making resources and leadership available to achieve these goals and to foster the integration of cardiovascular wellness, health care, research and education.

Dr. Ron Sigal

a normal working heart, there's a range of parameters that is normal, but in certain heart disease states, too much calcium can be released or calcium is released earlier than expected, causing arrhythmic disturbances in the heartbeat.

"We've made important discoveries concerning the function and regulation of proteins that transport calcium," says Lytton. "Our work is reaching a stage of maturity where one can begin to think of ways in which our fundamental discoveries could be exploited to treat disease and improve health. This transformation is easier in a place like Calgary where we have teams that focus on translating basic discovery into clinical advances."

After working at Harvard University and the University of Toronto, Lytton says being a part of the research community in Calgary offers its own rewards.

"The structure of research in Calgary - particularly at the Faculty of Medicine, with its focus on interdisciplinary teams studying systems such as cardiovascular or neuronal in a collaborative environment - was a real attraction," he says. "There is also a strength here in the number of people studying various aspects of the role calcium and calcium regulatory proteins play in health and disease."

Exercise makes dramatic difference for people with diabetes

For people with type 2 diabetes, getting to the gym for a workout means more than just an athletic build or a toned body.

According to research by Dr. Ron Sigal, associate professor at the University of Calgary's departments of cardiac science, medicine, community health sciences and kinesiology, patients with type 2 diabetes can dramatically reduce their risk of cardiac events like heart attacks and strokes with a combination of aerobic and weight resistance exercise.

"Someone with type 2 diabetes who wants to maximize the benefit from lifestyle would get the most reward from doing both types of exercise - aerobic and resistance exercise," Sigal says.

The study, Effects of Aerobic Training, Resistance Training, or Both on Glycemic Control in Type 2 Diabetes, randomly assigned 251 previously-inactive people with type 2 diabetes into four groups: aerobic exercise only (walking, cycling, jogging), resistance exercise only (weight lifting), both aerobic and resistance exercise, and a control group who did not exercise.

The main study outcome was a change in blood glucose control, as reflected by Hemoglobin A1c. The combined aerobic and weight training group saw the greatest benefit with a reduction of Hemoglobin A1c by a full percentage point compared to the sedentary control group. This size of improvement, if sustained, would be associated with a 15 to 20 per cent reduction in risk of a major cardiovascular event like a stroke or heart attack.

During the study, the aerobic-alone group or aerobic-combined group started off by doing 15 to 20 minutes of moderate intensity exercise and then by the last half of the study they were doing 45 minutes at moderately high intensity (75 per cent of their maximum heart rate). The resistance exercise group started off doing one set of seven different exercises and by the end they were doing three sets of seven or eight exercises. The group used mostly weight machines, but also did crunches (sit-ups). The exercise programs were supervised by personal trainers.

While there may not be an exact threshold of how much exercise is needed to benefit, Sigal says every bit helps.

"A combined aerobic and resistance training program certainly proves feasible for this fairly large group, who were on average as overweight as most people are with type 2 diabetes and middle aged or older, but they were able to do it and still derive significant benefit from it," he says.

Sigal chuckles as he offers his testimonial on the value of exercise. "I've been doing exercises for some time and I don't feel any older than I did 10 years ago," he says.

As a member of the Libin Cardiovascular Institute of Alberta and the Julia McFarlane Diabetes Research Centre at the University of Calgary's Faculty of Medicine, Sigal started planning the study in 1999, with the help of $120,000 in funding from the Canadian Diabetes Association. And in 2001, the Canadian Institute for Health Research provided an additional $950,000 for the study to get underway at the Ottawa Health Research Institute.

McCaig Institute for Bone & Joint Health

The McCaig Institute for Bone & Joint Health changed its name in 2007 to honour the memory of Mr. J.R. "Bud" McCaig who played an integral part in the Institute's growth since 1989. The Institute shares McCaig's commitment to finding the underlying basis for the development of chronic joint conditions such as osteoarthritis and rheumatoid arthritis, and related diseases.

Ligaments feeling the healing

Feeling pain after spraining an ankle or injuring a knee ligament might not seem like it's doing you any good, but research from orthopedic surgeons Dr. Robert Bray and Dr. Paul Salo suggests otherwise.

The Faculty of Medicine surgeons have been collaborating for several years to investigate how specific molecules promote the healing process in joint tissue.

"There's a really dynamic process that takes place," Salo says, explaining that sensory nerves are a two-way street. "While carrying pain messages to the brain, the nerves also send messages the other way and spark the formation of new blood vessels and promote the healing process."

Salo identifies the study goal is to block the pain side and promote healing.

Including research on the nervous system in a cross-disciplinary approach is a relatively new line of thinking in bone and joint science.

"Despite the fact that the main symptom of a joint problem is pain, the nervous system has not traditionally been an area of interest for people studying the musculoskeletal system. Clearly joints are well-connected to the nervous system," Salo says.

In the last five years, Salo and Bray have been working to pinpoint the signalling molecules (neuropeptides) responsible for stimulating and regulating blood flow and the subsequent healing in ligaments.

"It's easy enough to say the nerves are promoting healing, but to zero in on which molecules are responsible is going to take a lot longer," Salo says. "But if we can do that, then we should be able to develop some form of an injectable treatment."

First joint transplant in Alberta reverses three years of pain

While on holiday in Kelowna, B.C., Eltoff Abdalla was accidentally pushed into the shallow end of a pool, breaking her knee bone (tibial plateau) in the process.

After suffering three years of chronic pain and reduced mobility because of the mishap, 34-year-old Abdalla received Alberta's first biological joint transplant at the Foothills Medical Centre, helping her get back to work and regain an active lifestyle.

"Having the procedure opened up so many opportunities. It gave me my life back," Abdalla says. "I think once you're stripped of your mobility, you can't even imagine how that really affects you at a young age."

The transplant of biological tissue is one of two types of procedures that the Joint Transplantation Program at the McCaig Institute currently specializes in.

Sue Hunter, coordinator of the program, says the ideal candidates for the procedures are patients who are not suitable for an artificial joint replacement because they are young and active. These individuals are looking to restore their quality of life after a trauma like a vehicle accident or athletic injury.

The crux of the procedure is the use of biological material – real bone and cartilage from young donors – to repair the damaged region.

Donor tissues can be stored at low temperatures for up to a month prior to transplantation. Ken Muldrew, a researcher with this program along with his colleagues in Edmonton, are close to discovering a way to freeze cartilage for transplantation and thus prolong the tissue storage time.

"The key challenge remains the availability of suitable donor tissue to meet this clinical need so that transplants can occur in a timely fashion," says Hunter.

Primarily located in the Faculty of Medicine, the McCaig Institute is comprised of a consortium of researchers including basic scientists, orthopaedic surgeons, rheumatologists, kinesiologists and biomedical engineers who bring diverse technologies and perspectives from various disciplines. The primary focus of the McCaig Institute is basic and clinical research, with the goal of understanding the basis for loss of bone and joint health, and how these debilitating chronic diseases and conditions develop.

The McCaig Institute is also a focal point for collaborative interactions with other independent entities that have complementary goals and skills. The McCaig Institute works with the Calgary Bone & Joint Health Program in the Calgary Health Region which focuses on clinical care, and with the provincial Alberta Bone & Joint Health Institute, which is dedicated to improving health services delivery to make the health system sustainable through appropriate care, for appropriate patients, at the appropriate time.

Research discoveries made at the McCaig Institute are quickly translated into better treatments for patients across Alberta through these partnerships as well as agencies such as The Arthritis Society.

"We all come together to form a truly world-class and unique Knowledge Translation Network," says Dr. David Hart, interim director. "These key partnerships enhance the return on the research investment to benefit patients and those at risk of bone and joint loss."

"Research at the McCaig Institute is uniquely positioned in Canada and North America to impact the bone and joint health of Albertans and all Canadians," he adds.

Josh Rosvold and Shon Darcy, PhD students in biomedical engineering, with the Rotobot

Dr. Carol Hutchison, who performed the transplant, is optimistic about the potential benefits of the treatment.

"The procedure shows great promise. It creates the possibility of making major trauma pain free," Hutchison says. "There is a decreased risk of infection because we do not have to undertake immuno-suppressant therapy. That is a significant benefit."

Dr. Norman Schachar, one of Calgary's first resident orthopedic surgeons, echoes her optimism and points to the program's goal.

"The holy grail that we're looking for is to make this a standard practice," he says. "The ability to implant something that is biological in a young person offers a tremendous benefit."

For Abdalla, the procedure has not only made a world of difference but also solidified her belief in taking decisive action.

"You have to make the choice – are you going to let the injury determine who you are or are you going to try to make the best of it and get it fixed."

Use of kinematics and robotics in joint function research

Robots helping humans may seem like science fiction to some people, but a team of physicians and engineers at the McCaig Institute are working with a one-of-a-kind robotic model in hopes of learning more about joint function and osteoarthritis.

Dr. Cyril Frank, executive director, Alberta Bone & Joint Health Institute, has been collaborating with McCaig Institute engineers Nigel Shrive, PhD, and Janet Ronsky, PhD, using a custom-modified, commercially available robot, known as the Rotobot. Frank is the McCaig Professor in Joint Injury & Arthritis.

This research focuses on using this robotic system to translate motion analysis from joints of live models to simulate the same three-dimensional positions in the Rotobot. The system can then test isolated knee joints in the laboratory in a manner that mimics the living motion.

"This robot is the only one of its kind in the world that's working like this right now," says Frank.

The core of the team's work focuses on the knee – the joint takes the most punishment and bears the brunt of the body's weight in movement and activity.

While others have followed their lead with use of the Rotobot, the real secret is in how the robot is put through its paces.

"Others have bought the robot, but the magic in it is the control systems," Frank says. "Shrive and Ronsky and their engineering team have been the key designers and drivers behind the robotic model," he adds.

"The magic is actually in the software and the feedback to drive it – nobody else has been able to do that."

Frank is optimistic about the team's research too, adding that for Canadians, the work is particularly relevant.

"The incidence of arthritis is increasing with injury and with the aging population," he says. "It now affects between one in six and one in seven Canadians. That means four to five million people have arthritis, of which 90 per cent is osteoarthritis."

The tech-savvy group has recently received a grant from the Canadian Institutes of Health Research (CIHR) to expand the research over the next five years.

Southern Alberta Cancer Research Institute

The fight against cancer is one that is being fought on many fronts and continues to achieve many victories. Increased life expectancies through improved treatments are a result of ongoing clinical trials and laboratory-based medical research activities.

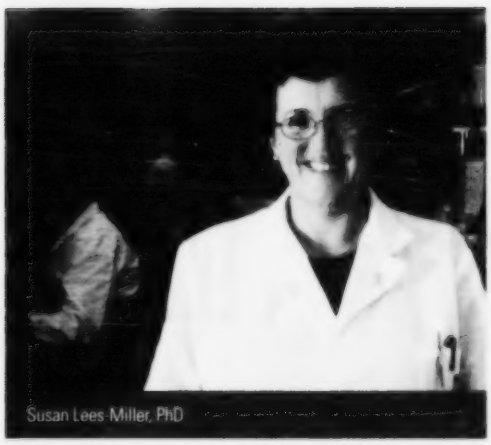
Calgary is recognized around the world as one of the centres of excellence in patient care, clinical trial activity and medical research advances. Activities at the University of Calgary, the Tom Baker Cancer Centre, and the Alberta Children's Hospital ensure that not only do cancer patients in Southern Alberta continue to receive the best and latest cancer treatments but that these treatments continue to improve, based on the leading edge science and knowledge of those physicians and scientists working in the field.

One of these examples of excellence is the Clark H. Smith Brain Tumor Centre and its success in the testing of experimental virus treatments in patients with cancer. This program takes the findings of laboratory-based research using viruses to treat brain tumours and translates it into new clinical treatments for patients. Early results of the program are promising and the research is now entering a second phase of patient treatment.

This multidisciplinary approach is one that SACRI is taking in other programs such as Hughes Children's Cancer Research Centre and Molecular Epidemiology, to name two.

SACRI is continuing its expansion into new laboratory space in the Health Research Innovation Centre. This space accommodates many of our scientists, and provides a home for the infrastructure and administration needed to support a collaborative Institute. While many of the members of SACRI, physicians and cancer professionals, will continue to work and maintain office space in their appropriate organizations such as the Tom Baker Cancer Centre, research activity will be managed through SACRI's home in the Health Research Innovation Centre.

The SACRI executive works closely with the Alberta Cancer Board, the Faculty of Medicine and the Calgary Health Region, building on community partnerships to ensure the ongoing success of Calgary's cancer research programs.



Susan Lees-Miller, PhD

Attacking the bad cells and keeping the good

As a junior high school student in Wales, scientist Susan Lees-Miller, PhD, became interested in learning about DNA and proteins.

"I've always been interested in how cells work and how they do the things they do. It's fascinating," Lees-Miller says. "I think it clicked way back in grade school."

Lees-Miller holds the Engineered Air Chair in Cancer Reseach. These days, she is exploring how to control the damage to cells during radiation treatments on cancer patients at SACRI.

"One of the problems with radiation treatment and also treatments with many chemotherapeutic drugs is that these agents damage the normal, surrounding cells as well as the cancer cells," she explains. "What we'd like to do is target the tumour cells, but not damage the other cells."

At a molecular level, the protein chemist is figuring out how proteins repair DNA damage and how they interact with each other. Lees-Miller wants to know how to activate the genes in tumour cells to make them highly sensitive to radiation and therefore make them more vulnerable to treatments than other cells.

"There are a lot of different things going on at the site of DNA damage and we're trying to understand how the repair process works," she says.

Lees-Miller says her lab is currently identifying defective tumour cells that have lost some of the enzymes required to repair DNA damage. These cancer cells don't have as many repair pathways to heal or fix their DNA. She wants to try new drugs that will "knock out" their limited repair options without affecting the other good cells in the area.

"Our preliminary results have suggested that this strategy could be effective for some types of cancer," she says. "If this all works out then it's looking very promising and we could have something very exciting going on."

Lees-Miller believes great things can be achieved at the Institute.

"At SACRI, we've got the basic scientists and the clinicians talking to each other and working together. I really think that's where the breakthroughs are going to come from: taking the basic scientific findings and applying them to what's happening in the clinic."

Encouraging and facilitating integrated transdisciplinary cancer research and training is the primary role of the Southern Alberta Cancer Research Institute (SACRI), an Institute formed by a partnership between the Faculty of Medicine and the Alberta Cancer Board.

SACRI program puts power of prevention into people's hands

A program at SACRI is on a mission to find out how to stop cancer before it even develops.

The Strategic Research Program in Molecular Cancer Epidemiology is looking at both genetic indicators and environmental factors to see the big picture of why some people are more susceptible to cancer than others.

SACRI cancer epidemiologist Christine Friedenreich, PhD, is looking at the effects of physical activity on cancer. She says exercise definitely plays a role in reducing the risk of breast cancer and colon cancer.

She adds it is very likely that physical activity reduces the risk of ovarian, endometrial (in the uterus lining) and lung cancer.

Friedenreich, who also works with the Alberta Cancer Board, finds the breast cancer research results particularly uplifting because they give hope to women at risk of getting the disease.

"Those results have a very positive take-home message for women," the SACRI researcher says. "It's something pretty empowering for them because they have some control over lowering the risk."

"We have the largest study in the world on exercise for breast cancer prevention," she adds.

The program is overseeing "The Tomorrow Project," which is monitoring 13,000 people to see who develops cancer and other diseases, while looking at lifestyle and inherited factors. As part of the Canadian Partnership Against Cancer, the study will receive funding to begin collecting physical samples as well as increase the number of people to 50,000, as part of a large, Canada-wide cancer study of about 300,000 people.

"There are many areas of medicine, and I decided I wanted to be part of the prevention," Friedenreich says.

Weapons against brain cancer

Many people have never heard the word *oligodendrogliomas* let alone pronounce it. "It's a kind of brain cancer," says Dr. Gregory Cairncross. "It has occupied my attention for close to 25 years." Cairncross holds the Alberta Cancer Foundation Chair in Brain Tumour Research.

The director of the Clark H. Smith Brain Tumor Centre knows a lot about the cancer that develops in mostly young adults. The Centre is looking at new ways to treat this very invasive form of brain tumour that cannot be treated through surgery because it intertwines with the surrounding brain cells.

The Smith Centre is focused on understanding the biology of brain tumour stem cells, which Cairncross believes are the likely cause of oligodendrogliomas. His program has a Cancer Stem Cell Core Facility that grows stem and tumour cells, a Preclinical Testing Core Facility to test mainly new drugs on stem cells, and a "Brain Chip" gene expression analysis platform, which can present the genetic profile of cancer cells on a chip that's about the size of a postage stamp.

"Our goal is to learn more about the basic nature of these tumours and develop insights into treatments for them," Cairncross says.

Cairncross's curiosity about oligodendrogliomas began 20 years ago in medical school when he discovered that these tumours were more sensitive to chemotherapy than other cancers.

But as time went on, Cairncross found not all oligodendrogliomas were sensitive to chemotherapy and has since discovered genetic markers to guide doctors when treating the tumours.

"Nothing makes me happier than watching a patient get better as their tumour shrinks," he says.

Cairncross also applauds the up and coming researchers at SACRI.

"At this stage of my life, I especially enjoy seeing smart, young people working on these problems," he says. "I enjoy the notion of passing the torch to people who will make the next generation of discoveries."

Centre for Health and Policy Studies

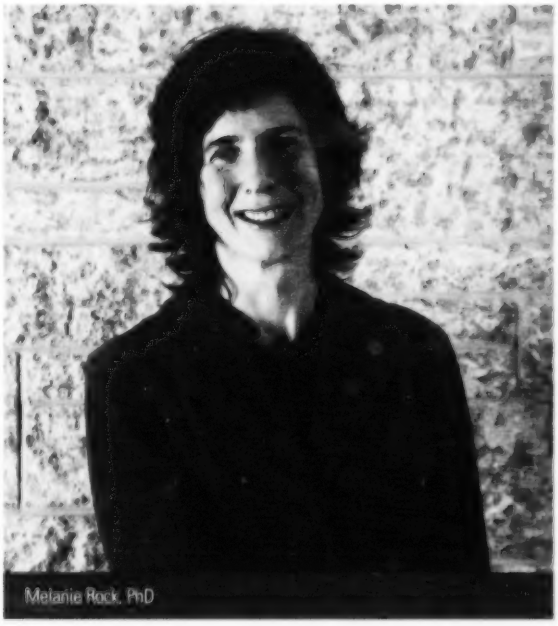
The Centre for Health and Policy Studies (CHAPS) exists to foster programs of health and policy research that advance health improvement and health care delivery.

Investigators in CHAPS have had repeated success in competitions for operating and salary awards. In the 18 months from January 2006 to June 2007, investigators in CHAPS and the Department of Community Health Sciences published 136 papers and attracted $58.5 million in research funding, of which $21.3 million was held as primary investigators. Individual and collective research efforts include:

- Population health intervention research
- Animal-human interaction
- Health services research in cardiovascular nursing care
- Methodological research and ICD-10 classification systems
- Access to services and waiting times
- Clinical, epidemiologic, and innovative research such as epidemiology and care of the aging
- The Ward of the 21st Century

CHAPS also supports collaborations with the majority of its research programs involving both health services and population health researchers. In addition, CHAPS supports the SEARCH Canada Program to build capacity in community-based research and has recently established a health technology and appraisal unit.

"Expansion of CHAPS is aimed at evolving into a larger integrating force focused on health services and population health research, with the overarching goal of creating a seventh University of Calgary Institute – the Calgary Institute for Population and Public Health," says Dr. Tom Noseworthy, director of CHAPS.



Melanie Rock, PhD

CHAPS
CENTRE FOR HEALTH AND POLICY STUDIES

Socioeconomic status and weight: Answering the important questions

Researcher Lindsay McLaren has always been interested in how body weight is viewed because unlike many other health issues, it is something that is visible.

"In our society, there is an enormous amount of judgment and stigma placed on one's weight," says McLaren, PhD, a member of the Centre for Health and Policy Studies (CHAPS) and an assistant professor in the Department of Community Health Sciences.

While conducting her research, which is focused on the relationship between socioeconomic status (SES) and health, McLaren was surprised to discover that on average, men and women with higher education tend to be thinner. On the other hand, men with higher income tend to be heavier and women with higher income tend to be thinner.

"So my research is focused on figuring out these complexities and teasing these things apart," she says.

McLaren believes these results are related to social distinctions and stereotypes. The men who were most likely to be heavy were usually in jobs with management or supervisor roles.

"Extra physical weight might help those men to convey a physical dominance or authority," she says. "It could hold some social value to be bigger in those situations."

When asked what she hopes to come out of her research, McLaren says she wants it to answer some big unanswered questions about the public's relationship with its physical well-being.

"Humans are very social beings and explaining the interaction of society and health is a fundamentally important question," she explains. "This is the type of research that's going to help answer that question."

Pets play significant role in our health

During her research into the translation of new knowledge about diabetes, medical anthropologist Melanie Rock, PhD, began to take notice of a topic that would pop up during conversations.

"More than once in my discussions about my work, people would tell me about a cat or a dog that they were treating with diabetes or knew was being treated for diabetes," Rock says. "That caught my attention, it caught my interest and I thought it would be fun to follow up on that."

After doing some digging, Rock discovered that little research has been done on people's experiences in seeking veterinary care for their pets, and nothing at all on possible connections between treating diabetes in pets and human health in general.

The UCalgary Faculty of Medicine professor is leading the way with a qualitative study that looks at what people do to take care of their cats and dogs with diabetes, why they do it, and how they use new knowledge about diabetes gained from caring for a pet in thinking about their own health and the health of other people.

"Pet ownership is very common throughout Canada and many other countries," she explains. "So from a public health perspective, that potentially is very important. By caring for sick pets, people may be learning about human health problems and acting in ways that could promote their own health."

Based on interviews with pet owners and veterinarians, Rock has found that there is a lot to be learned about these relationships. Although it is still fairly new, she says the research has highlighted new connections between veterinary care for pets and public health.

"In one case, I interviewed a pet owner who has diabetes and he identified the diabetes in his dog based on his own symptoms," she recalls. "The potential exists for people who have cared for a diabetic pet to recognize the symptoms in themselves or in other people."

But most importantly, Rock says the ongoing study highlights the importance of relationships: "Health happens - or doesn't happen - in the context of relationships."

Centre for Advanced Technologies

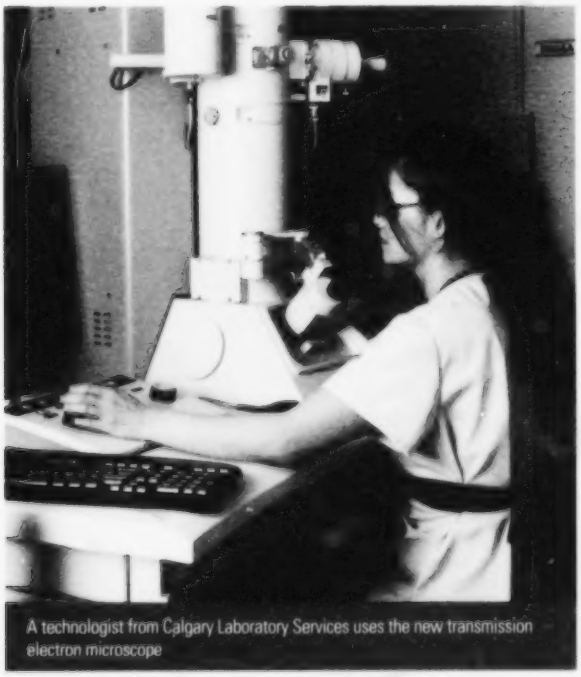
The Centre for Advanced Technologies (CAT) is the technological cornerstone of biomedical research at the Faculty of Medicine.

At CAT, researchers not only investigate and develop new biomedical technologies, they also provide advanced technological support to scientists investigating the basic building blocks of the human body – the science of genomes, proteins and metabolites.

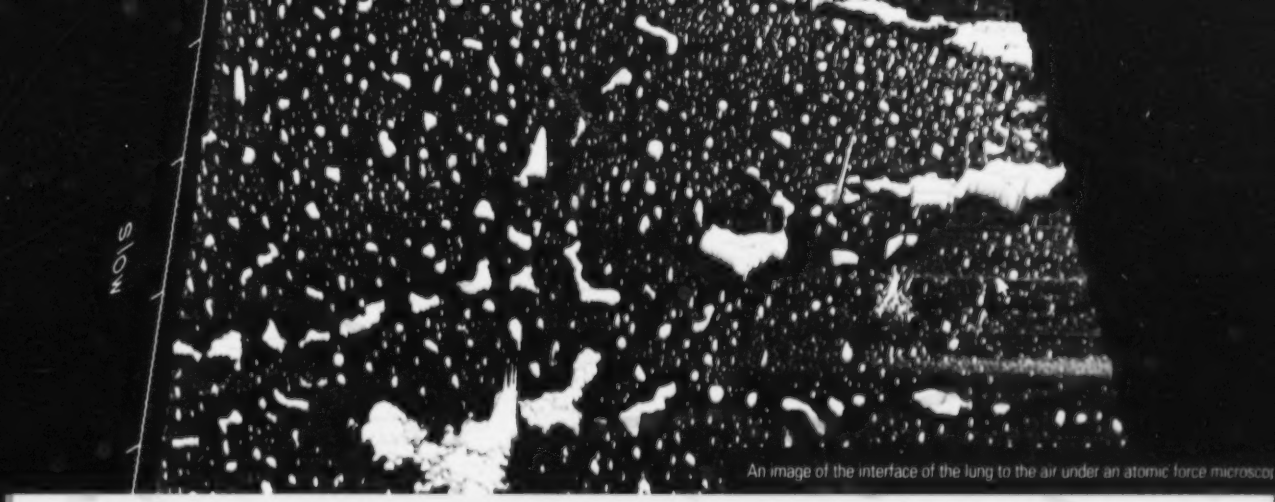
CAT provides a wide array of technological facilities whose primary focus is to serve the research programs of the Faculty of Medicine. These facilities currently include:

- The Clara Christie Centre for Mouse Genomics
- Health Sciences Animal Resources Centre (HSARC)
- The Libin Gene Therapy Unit
- The University Core DNA Services (UCDNA)
- Peptide Synthesis Laboratories
- The Hybridoma & Antibody Facility
- The Southern Alberta Mass Spectrometry Facility
- The Southern Alberta Microarray Facility
- The Flow Cytometry Facility
- The Microscopy and Imaging Facility
- The Sun Center of Excellence for Visual Genomics
- The Biotechnology Training Centre
- The Biomedical Technical Support Centre (BTSC)
- Central Sanitation and Sterilization (CSS)

"The technologies and services we provide are essentially the engines that support innovation in biomedical research. We're focused on emerging technologies in the health services. Without our infrastructure, many of the research programs currently underway at the Faculty would be impossible," says Christoph Sensen, PhD, director, CAT.



A technologist from Calgary Laboratory Services uses the new transmission electron microscope



An image of the interface of the lung to the air under an atomic force microscop

New technology gets close to the human body

One facility at CAT is helping make the world a better place by taking a very, very close look at it.

The Microscopy and Imaging Facility (MIF) is using its deep pool of sophisticated microscopes to foster some serious innovation within its walls. Using instruments that have been recently acquired or significantly upgraded in the past 12 months provides facility users access to a very powerful set of research tools.

"This facility exposes me to a full-spectrum of research projects in medicine and beyond medicine," says MIF director Matthias Amrein, PhD. "I get to work with and know a lot of the top-tier researchers that we have at the University of Calgary."

The facility has used its several atomic force microscopes (AFMs) for a range of work that includes: looking at the interactions between potentially harmful or beneficial airborne particles and the molecular film lining the lung's surface, and conducting innovative research on particles that stimulate the immune system during immunization.

"Like a record player, the atomic force microscope has a needle that scratches surfaces, very, very lightly," Amrein explains. "We can see how single molecules bind together and let go of each other at an extremely accurate level."

MIF provides the research community with access to use its scanning electron microscopes (SEMs), transmission electron microscopes (TEMs) and light microscopes for work in a variety of fields. These technologies are used most extensively by the Faculty of Medicine for a wide range of studies in cancer, infection, auto-immune disease, diabetes, cystic fibrosis and other conditions.

Many of the important discoveries made at the Faculty of Medicine have relied on the facility in one way or another. Engineers and scientists from other faculties and industry perform studies at the MIF, on anything from nano-particles to other novel materials. These studies are applied to fuel and solar cell development, waste treatment and more. A researcher from paleontology is even examining the microscopic features in fossilized teeth to determine the diet of dinosaurs.

The (anti)bodies behind the research

When researchers are in need of custom antibodies for their work, SACRI Antibody Services (SAS) is the place to go.

As a program delivered by the Faculty of Medicine's Southern Alberta Cancer Research Institute (SACRI), SAS provides a large number of scientists and doctors with antibodies – proteins found in the body that the immune system uses to fight invading viruses and bacteria.

"We're a core facility that provides antibodies to researchers," says Donna Boland, manager of the SAS facility. "A big focus among our clients is on cancer research."

As one of the core facilities at CAT, SAS not only provides antibodies for work with cancer cells, but also for DNA research and treatment for neurodegenerative diseases, such as Tay-Sachs.

There are some SAS-produced antibodies on the market for breast cancer research including one simply called Cab (Calgary Antibody).

"I like how we've changed throughout the years," Boland says, who has been manager since 1996. "I like how we've broadened our services, how the techniques in our field are changing all the time."

Recently, the facility acquired a robotic work station to help SAS increase its antibody-production workload. It also has the technology to purify antibodies as well as a BiaCore 3000, which can monitor molecular interactions in real time. It uses chicken eggs as hosts for antibody production.

"I want our antibodies to help people figure out the process in cancer and that will eventually lead to new treatments," Boland says. "It is essential to do the basic research before you reach the clinical level with patients."

Graduate Science Education

Graduate Science Education supports the training of future scientists who will play important roles in universities, business and society.

In our research-intensive environment, students in the master's (MSc, MBT) and doctoral (PhD) programs carry out studies with some of the best researchers in their fields. They are registered in one of our graduate programs that cut across departments and institutes and are administered by the Office of Graduate Science Education.

The eight graduate programs in GSE are:

- Biochemistry & Molecular Biology
- Biomedical Technology
- Cardiovascular & Respiratory Sciences
- Community Health Sciences
- Gastrointestinal Sciences
- Microbiology & Infectious Diseases
- Medical Science, including specializations in Immunology, Cancer Biology, Critical Care Medicine, Immunology, Joint Injury & Arthritis, Medical Education, Mountain Medicine & High Altitude Physiology, and Molecular & Medical Genetics
- Neuroscience

Graduate Science Education depends on the personal mentoring of the student by a faculty member, which ensures both a high quality education and a high success rate. The one-on-one instruction is supplemented by more than 120 intensive graduate courses in the Faculty of Medicine. Currently more than 475 students are in our graduate programs, 42 per cent of them doctoral students.

In 2007, we convocated 91 students. The changing demographics of Canadian academia, together with the burgeoning biotechnology sector, point to a fast-growing job market for MBT, MSc and PhD students. Indeed, our graduates are in high demand from industry and universities, and 90 per cent of them are able to apply their training in future careers.

"Graduates from the combined MBT-MBA program are fully versed in all aspects of biotechnology from the lab bench to the board room, and will contribute to the growing biotech business and economy in Alberta and beyond," says Frans van der Hoorn, associate dean, Graduate Sciences Education.

The Faculty of Medicine provides an interdisciplinary graduate training environment in its six research institutes.

In addition, more than 35 graduate students are registered in the Leaders in Medicine program, in which they earn both an MSc or PhD with their medical degree. The objective of this program, one of the largest of its kind in North America, is to train clinician-scientists for academic medical research careers and for careers in the design, management and implementation of health care delivery programs.

Our graduate students are supported through competitive awards from external agencies including the Alberta Heritage Fund for Medical Research (AHFMR), Canadian Institutes of Health Research (CIHR), Natural Sciences and Engineering Research Council of Canada (NSERC), Alberta Cancer Board (ACB) and Heart & Stroke Foundation (40 per cent of total); supervisor operating grants; Faculty of Graduate Studies Scholarships; and graduate assistantships. Graduate student funding in the Faculty of Medicine totaled $6.97 million in 2007.

"The Achievers in Medicine Scholarship Awards and National Competitions held in Calgary have had a significant impact on our recruitment successes," says van der Hoorn.

In addition to graduate students, the Faculty of Medicine is home to more than 200 postdoctoral trainees who are a pivotal part of the Faculty's research endeavours, and represent the next generation of outstanding independent investigators.

Researcher Susan Slaughter (second from right) with (from left to right) Doreen, Werner, Mary and Red

GSE student wins Governor General's Gold Medal

After winning the Governor General's Gold Medal for academic achievement, University of Calgary PhD graduate Grant Gordon can't help but embody an "aw shucks" attitude by heaping praise upon everyone but himself.

This past year he earned the prestigious award working on his thesis on novel ways by which the communication points between different neurons change their strength.

"To be honest, I felt undeserving," he says. "I spent five years working with numerous other graduate students whom I feel are very bright and talented individuals. To be singled out from them seems a bit strange, but an honour."

"Grant has an infectious enthusiasm for science and actually, for most things he does in his life. He is willing to take risks in the lab; he is willing to ask tough questions and then design and conduct experiments regardless of their degree of difficulty," says Gordon's supervisor, Jaideep Bains, PhD, assistant professor, Hotchkiss Brain Institute.

In his studies, Gordon, in conjunction with his neuron-loving cohorts, helped change the way people think about how communication at synapses (neurons) can be modified. In the past, it was believed that changes in the efficiency of this communication were regulated entirely by mechanisms present at the synapses themselves. Gordon and his team, however, found that in some cases, neurons depend on support cells, called glia, to alter communication at synapses.

"One of the manuscripts published from my thesis work demonstrated that glial cells in the hypothalamus released signaling molecules in response to noradrenaline and that this process was essential for long-term synaptic strengthening," he says. "Owing to this work, and the work from several other laboratories, the doctrine is beginning to be dispelled, by which neurons are solely responsible for governing the state of their synapses."

His research contributes directly to the study of neurological disorders that plague people in society, including Gordon's father, who has Parkinson's disease.

"If I am fortunate enough to contribute something to Parkinson's research, either directly or indirectly, I will take pride in it," he says.

Gordon's love for science shows that, medal or no medal, he will continue to excel.

"Science is a wonderful balance between logical reasoning and creativity," he says, "the outcome of which manifests itself right in front of your eyes. Who wouldn't love that?!"

Christopher Altier studies pain to gain understanding

Christopher Altier enjoys his neurons. So much that he's transplanted himself from his native France to the University of Calgary where he can be on the cutting edge of research on the subject.

His findings on the regulation of ions in and out of cells and how neurons communicate may institute a drastic change in the way that we look at pain in the body. Ion channels, the pore-forming proteins that allow the flow of ions in and out the cells, are pharmacological targets for many diseases like epilepsy and some cardiac afflictions. Specifically, Altier is looking at the regulation of these ion channels, their action within cells and the modulation of their activity, which reflect how the message of pain is presented to the brain.

"We have a good project regarding the role of calcium channels in visceral pain," he says.

Currently, scientists don't fully understand pain that is visceral, or instinctual and automatic. Altier's studies over the next two years could change all of that. He first studied ion channels in Montpellier, in the south of France near the Spanish border. His master's degree was a study about potassium channels in heart failure, closely related to the calcium channels he's studying now.

During his studies in France, he communicated with laboratories in the Faculty of Medicine doing parallel research. When he decided he wanted to do a post-doctorate fellowship, his travels brought him here.

"The lab where I am is really competitive and really good," he says. "I felt it was a good lab for research."

From nursing to Alzheimer's research, Susan Slaughter's hard work pays off

For Susan Slaughter there are no short cuts – no easy ways out. That's why, this year, she will defend her doctoral thesis more than a quarter century after having her first research paper published in a peer-reviewed journal.

In 1997, Slaughter was working as a nurse in a long-term care facility where she started to notice that families and the caregiving team had different perspectives on treatments for her older residents with Alzheimer's disease. She noticed that a resident's family would have one opinion regarding the care of their loved one, while nurses would have another opinion. Not all functional loss in people with Alzheimer's disease is attributable to Alzheimer's disease; that makes it difficult to diagnose why someone with Alzheimer's loses the ability to walk. By understanding the various perspectives and actions taken during the transition period when someone is losing the ability to walk, Slaughter believes that better care can be introduced to the patients.

Prior to working as a staff nurse on a geriatric rehabilitation unit at the Montreal General Hospital, Slaughter was a research assistant in a pharmacology lab. This experience whetted her appetite for research.

Through the Department of Community Health Sciences, Slaughter is investigating progressive functional decline associated with Alzheimer's disease, excess disability and functional transition. Specifically, she is using observation, interviews and survival analysis to examine older adults' transitions in the ability to walk and eat.

"I'm looking at the transitions that older adults with dementia go through as the disease progresses," she says. "The clinical importance of these transitions is clear as families and staff regularly have to make decisions on how to respond to the ambiguity of functional losses of people experiencing Alzheimer's disease."

Slaughter's research is funded by the Alberta Heritage Foundation for Medical Research. "Working with seniors in various nursing homes in Calgary and southern Alberta has been a privilege," she says. "The research itself is exciting and I'm just grateful for the experience of working with these amazing seniors."

Calgary Centre for Clinical Research

This new clinical trials co-ordination centre is a first for Calgary.

This coming fall, the University of Calgary Faculty of Medicine will have a stunning new home for the Calgary Centre for Clinical Research (CCCR) – the first completely integrated clinical trials centre in Calgary. The Centre will be located in UCalgary's new Teaching, Research, and Wellness (TRW) building, built in close proximity to the Calgary Health Region's Foothills Medical Centre. It will be the web-linked hub for health and clinical research done throughout the Calgary Health Region, and designed to lead and conduct large clinical trials by Calgary investigators and their colleagues from around the world.

The Calgary Centre for Clinical Research aims to be a state-of-the-art clinical trials and epidemiology co-ordination facility, supporting health investigators within the Faculty of Medicine's research institutes, the Calgary Health Region and other Faculties at the University of Calgary. Patients in research studies will participate in studies of leading edge treatments and care on the floor, which includes a dedicated research pharmacy. The Centre is founded upon the Faculty's philosophy of flowing research discoveries from the laboratory bench to the bedside of patients and beyond. It is set up to enable clinicians and scientists to collaborate more efficiently on clinical research by working directly with patients, rapidly applying their findings in the laboratory, and, finally, developing new medical solutions for patients.

The Centre will also offer a web-based information system that will allow patients participating in research studies to be seen in numerous locations across Calgary, rather than having to go only to the Foothills site. "Research will be taken to people near their homes as one way of recognizing and thanking them for their participation in these important studies," says Dr. Bob Sheldon, associate dean of clinical research, UCalgary Faculty of Medicine, and Vice President of Research, Calgary Health Region.

Dr. Bob Sheldon

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Chairs and professorships

Chairs and professorships are a means of selectively developing, promoting, and recognizing excellence in research and scholarship at the University of Calgary. The annual budget associated with a chair can be used to recruit a candidate of international stature to lead a research program, or to strengthen a research program in a specific area.

Our endowment funds have matched pace with the rest of our growth. Valued at more than $40 million just seven years ago, our total endowment today is over $96 million. Ten years ago we had one research chair, today we have 45.

Alberta Cancer Foundation Chair in Brain Tumour Research	Dr. J. Gregory Cairncross
Alberta Cancer Foundation Chair in Molecular Cancer Epidemiology	In search
Alberta Children's Hospital Foundation Chair in Pediatric Rehabilitation	In search
Alberta Children's Hospital Foundation Chair in Pediatric Research	In search
Alberta Children's Hospital Foundation Professorship in Child Health and Wellness	Dr. Brent Hagel
Alberta Children's Hospital Foundation Professorship in Pediatric Hematology	In search
Alberta Children's Hospital Foundation Professorship in Pediatric Surgery	Dr. David Sigalet
Roy and Joan Allen Professorship in Sight Research	Dr. N. Torben Bech-Hansen
AMF/Hannah Professorship in the History of Medicine	In search
Andrew Family Professorship in Cardiovascular Research	Dr. William Cole
Arthritis Society Chair in Rheumatic Diseases/Rheumatology	Dr. Marvin Fritzler
The Roy and Vi Baay Chair in Kidney Research	In search
John A. Buchanan Chair in General Internal Medicine	Dr. William Ghali
The Calgary Foundation-Grace Glaum Professorship in Arthritis Research	Dr. David Hart
Campbell McLaurin Chair for Hearing Deficiencies	Dr. Jos Eggermont
Arthur J.E. Child Chair in Rheumatology Research	In search
Crohn's & Colitis Foundation of Canada Chair in Inflammatory Bowel Disease Research	Dr. Keith Sharkey
Cuthbertson & Fischer Chair in Pediatric Mental Health	In search
Enbridge Research Chair in Psychosocial Oncology	Dr. Linda Carlson
Engineered Air Chair in Cancer Research	Dr. Susan Lees-Miller
GSK-CIHR Professorship in Inflammatory Lung Disease	Dr. Richard Leigh
The Dr. Robert Haslam Chair in Child Neurology	In search

The Heart and Stroke Foundation of Alberta, NWT and Nunavut Chair in Cardiovascular Research	Dr. Henry Duff
The Heart and Stroke Foundation of Alberta, NWT and Nunavut Chair in Stroke Research	In search
The Heart and Stroke Foundation of Alberta, NWT, and Nunavut Professorship in Stroke Research	Dr. Michael Hill
The Husky Energy Chair in Child and Maternal Health	In search
Kids Cancer Care Foundation Chair in Pediatric Oncology	In search
Kinsman Chair in Pediatric Neurosciences	Dr. Sam Wiebe
The Frank LeBlanc Chair in Spinal Cord Research	Dr. Peter Stys
Jessie Boden Lloyd Professorship in Immunology Research	Dr. Chris Mody
Markin Chair in Health and Society	Dr. Penny Hawe
McCaig Professor in Joint Injury & Arthritis	Dr. Cy Frank
Julia McFarlane Chair in Diabetes Research	Dr. Pere Santamaria
Merck Frosst Chair/Professorship in Cardiovascular Research	In search
Fraser Mustard Chair in Childhood Development	Dr. Margaret Clarke
Novartis Chair in Schizophrenia Research	Dr. Jean Addington
Parkinson's Society of Southern Alberta / Suter Professorship in Parkinson's Research	Dr. Bin Hu
Shoppers Drug Mart Professorship in Women's Health Research	Dr. Lynn Meadows
Calvin, Phoebe & Joan Snyder Chair in Critical Care Research	Dr. Paul Kubes
Brenda Strafford Foundation Chair in Alzheimer Research	Dr. Minh Dang Nguyen
Brenda Strafford Foundation Chair in Geriatric Medicine	Dr. David Hogan
The Dr. Lloyd Sutherland Chair in Inflammatory Bowel Diseases	In search
The Svare Professorship in Health Economics	Dr. Herb Emery
Western-ASRA Chair in Bacterial Biofilm Research	Dr. W. Shawn Lewenza
Wood Professor in Joint Injury Research	Dr. Ronald Zernicke

Financial Statements 2006/07

Revenue for Biomedical and Health Care Research by Source of Funds
(exclusive of research funds reported below)

Federal Government Source	$44,457,488.05
Provincial Government Source	$33,279,050.47
National Foundations	$9,649,859.25
Provincial Foundations	$4,144,692.57
Private, For-Profit Canada	$7,259,386.42
Local Sources	$16,457,983.71
Internal Sources	$6,913,223.52
USA Sources	$7,606,364.74
Other Foreign Sources	$775,918.65
Hospital/University	$3,475,304.09
Total Revenue for Biomedical Research	$134,019,271.47

In addition, Reach!, the fundraising partnership between the University of Calgary, the Calgary Health Region, and the Calgary Health Trust, has raised $250 million to date in support of medical research, education, and leading-edge clinical care.

Provincial Government Sources
(includes departments and affiliated agencies)

AB Agriculture, Food & Rural Development	$10,431.44
Alberta Agricultural Research Institute	$1,137,385.00
Alberta Cancer Board	$4,776,203.42
Alberta Gaming Research Institute	$65,267.00
Alberta Health	$2,610,561.54
Alberta Heritage Foundation for Medical Research	$18,280,962.80
Alberta Innovation and Science	$462,359.06
Alberta International Medical Graduate Program	$768,888.97
Alberta Science and Research Authority	$138,751.19
Alberta Science and Research Investments Program	$1,509,783.64
Calgary Health Region	$2,577,386.91
Capital Health Authority	$20,000.00
Cross Cancer Institute	$90,000.00
ICORE	$200,657.00
Ontario HIV Treatment Network	$1,740.00
Rural Physician Action Plan	$598,160.00
Worker's Compensation Board – Alberta	$30,512.50
Provincial Government Sources Total:	$33,279,050.47

Federal Government Sources
(includes departments, crown corporations and agencies)

Canada Foundation for Innovation	$12,916,932.85
Canada Research Chair Award	$50,000.00
Canadian Cochrane Centre	$1,000.00
Canadian Institutes of Health Research	$29,611,477.40
Environment Canada	$116,789.00
Government of Canada	$16,977.00
Health Canada	$37,836.30
International Development Research Centre	$82,600.00
Natural Sciences and Engineering Research Council	$847,483.00
Network Centres of Excellence	$691,550.00
Public Health Agency of Canada	$24,808.50
Social Sciences and Humanities Research Council of Canada	$60,034.00
Federal Government Sources Total:	$44,457,488.05

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